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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict jcb performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 065626

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

ORNAMENTAL-IRON WORKER (const.) 4-84.020
STRUCTURAL-STEEL WORKER (const.) 4-84.010

B-559 S-280

(Supersedes B-501)

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U. S. Employment Service
in Cooperation with
Indiana State Employment Service

September 1963

GATB #2374

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

ORNAMENTAL-IRON WORKER (const.) 4-84.020
STRUCTURAL-STEEL WORKER (const.) 4-84.010

B-559

Summary

The GATB, B-1002A, was administered during May 1961 to a final sample of 77 male apprentice Ornamental-Iron Workers 4-84.020 and Structural-Steel Workers 4-84.010 employed by various firms in Gary and Hammond, Indiana. The criterion consisted of supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes S-Spatial Aptitude, P-Form Perception, Q-Clerical Perception and M-Manual Dexterity were selected for inclusion in the final test norms.

GATB Norms for Ornamental-Iron Worker (const.) 4-84.020 and Structural-Steel Worker (const.) 4-84.010, B-559.

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
S	CB-1-F CB-1-H	90	S	Part 3 Part	85
P	CB-1-A CB-1-L	80	P	Part 5 Part 7	80
Q	CB-1-B	90	Q	Part 1	90
M	CB-1-M CB-1-N	90	M	Part 11 Part 12	85

Effectiveness of Norms

The data in Table IV indicate that only 64 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 75 percent would have been good workers. 36 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 25 percent would have been poor workers.

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupations of Ornamental-Iron Worker 4-84.020 and Structural-Steel Worker 4-84.010.

Sample

The General Aptitude Test Battery, B-1002A, was administered from May 24 to May 31, 1961 to a sample of 77 male apprentice Ornamental-Iron Workers 4-84.020 and Structural-Steel Workers 4-84.010. The sample was enrolled in the apprenticeship program of the Lake County Iron Workers Joint Apprentice Committee and was employed at the following firms in Gary and Hammond, Indiana:

Company

American Bridge Company
The Austin Company
Bethlehem Steel Company
Construction Associates
Hunter Construction Company
J. M. Foster Company
W. D. Foster Company
Walsh-Eickleay Company

The selection of the sample was on a voluntary basis and all individuals in the apprenticeship class were included in the sample. The apprenticeship requires 3 years for completion and selection is made by the Apprentice Committee on the basis of interest, previous work experience, attitude and former work and school records. High school graduation is required but exceptions are occasionally made. Although the apprenticeship requires only 3 years for completion, the experience range for the sample is shown in Table I as 6 to 96 months. This is because some of the sample had been employed as Iron Worker and Structural-Steel helpers prior to entering the program and this experience is not included.

TABLE I

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

N = 77	M	σ	Range	r
Age	24.7	2.8	20-31	.117
Education	11.5	3.1	8-16	.214
Experience	30.6	19.4	6-96	.178

III. Job Description

Job Title: Ornamental-Iron Worker (const.) 4-84.020 and Structural-Steel Worker (const.) 4-84.010.

Job Summary: Works as a member of a group that raises and places fabricated iron or structural steel members such as girders, plates and columns, and unites them permanently to form a completed structure or frame work for a structure. Bolts, clamps, or otherwise fits together various kinds of iron grills, gratings, special stairways, ornamental enclosures, and other ironwork not included as structural ironwork.

Work Performed: Works from a personal knowledge of steel erection procedures, reads blueprints, and works mathematical problems involving general trade mathematics, decimals and fractions. Rigs equipment to lift heavy steel members and move or hold them in position using fiber lines, wire cables, chains, hooks and mechanical hoisting equipment. Erects various types of scaffolding to work from. Bolts steel or iron in place, cuts steel parts with burning torch and bolt-cutters; welds parts together and performs other tasks requiring use of conventional hand tools.

Reads blueprints and performs mathematical calculations to assure correct cutting and fitting of fabricated members. Erects scaffolding, using knowledge of tying knots securely in manila rope to assure safety of workers; uses hand tools to erect metal scaffolds. Rigs rope, wire cables, chains and hooks to lift or move heavy members into position. Guides structural members into place. Alines rivet holes in members being placed with corresponding rivet holes in members already placed, by driving drift pins or handle of pin wrench through holes. Places several bolts through holes to sustain dead weight of member and hold it in position until all bolts have been placed and tightened or riveted into position. Welds various members together as directed in blueprints or building specifications. Cuts steel reinforcing rods and bolts with heavy bolt cutting tool. Fastens ironwork to walls of building by means of bolts, brackets, or anchors. Fastens newel posts, balusters, or other parts of stairways by bolting to supports or imbedding them in sockets. Forges, welds, cuts, and drills as needed. Performs many tasks requiring use of heavy electric drills and hand tools such as wrenches and hammers.

Course Description: The Apprenticship program requires 3 years for completion. This includes on-the-job training and classroom instruction in the following areas: Blueprint reading, mechanical drawing, iron work fabrication, welding and burning, structural steel work, iron work reinforcing, iron work rigging, safty, and general trade mathematics.

IV. Experimental Battery

All the tests of the GATB, B-10021, were administered to the sample group.

V. Criterion

The criterion consisted of supervisory ratings on USES Form SP-21, "Descriptive Rating Scale". Ratings were prepared on June 24, 1961 by the various foreman who were in the best position to evaluate the individuals actual performance on the job. The range of final criterion scores was 14-45, with a mean of 34.1 and standard deviation of 5.5

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Intelligence (G) - required to plan operational sequence of job and to use judgement in selecting work methods.

Numerical Aptitude (N) - required to work mathematical problems involving general trade mathematics, decimals and fractions; and to assure correct cutting and fitting of fabricated members.

Spatial Aptitude (S) - required to read and interpret blueprints.

Form Perception (P) - required to guide structural members into place; and to align rivet holes in members being placed with corresponding rivet holes in members already placed.

Finger Dexterity (F) and Manual Dexterity (M) - required to rig and hoist equipment; to move and lift heavy steel members; to cut with cutting torch; and to use hand tools such as wrenches and hammers.

On the basis of the job analysis data, Verbal Aptitude (V) is considered obviously unimportant for performing the duties of this job and is therefore considered an "irrelevant" aptitude.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 77

Aptitudes	M	σ	r
G-Intelligence	103.7	16.1	.209
V-Verbal Aptitude	95.9	15.8	.276*
N-Numerical Aptitude	99.4	15.9	.185
S-Spatial Aptitude	112.2	20.5	.062
P-Form Perception	107.4	17.6	.161
Q-Clerical Perception	96.6	10.9	.407**
K-Motor Coordination	95.4	19.1	-.208
F-Finger Dexterity	105.1	20.3	.121
M-Manual Dexterity	114.0	9.7	.154

**Significant at the .01 level
*Significant at the .05 level

C. Selection of Test Norms:

TABLE III

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X			X	X
Irrelevant									
Relatively High Mean				X	X				X
Relatively Low Sigma						X			
Significant Correlation with Criterion		X				X			
Aptitudes to be Considered for Trial Norms		V		S	P	Q			M

Trial norms consisting of various combinations of Aptitudes V, S, P, Q and M with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of S-85, P-80, Q-90 and M-85 had the best selective efficiency.

VII. Validity of Norms

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 36 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between test norms consisting of Aptitudes S, P, Q and M with critical scores of 85, 80, 90 and 85, respectively, and the dichotomized criterion for Ornamental-Iron Worker 4-84.020 and Structural-Steel Worker 4-84.010. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Test Norms for Ornamental-Iron Worker 4-84.020 and Structural-Steel Worker 4-84.010 (S-85, P-80, Q-90 and M-85)

N = 77	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	39	49
Poor Workers	15	13	28
Total	25	52	77

Phi Coefficient = .34

$\chi^2 = 8.955$

$P/2 < .005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes S, P, Q and M with minimum scores of 85, 80, 90 and 85, respectively, have been established as B-1002 norms for Ornamental-Iron Worker 4-84.020 and Structural-Steel Worker 4-84.010. The equivalent B-1001 norms consist of S-90, P-80, Q-90 and M-90.

IX. Determination of Occupational Aptitude Pattern

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 35 OAP's included in Section II of the Guide to the Use of the General Aptitude Test Battery, January 1962. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.